MAR 27 1922
GENERAL LIBRARY
MAR 27 192
UNIV OF MICH.

SCIENCE

NEW SERIES
VOL. LV, NO. 1421

FRIDAY, MARCH 24, 1922

SINGLE COPIES, 15 CTS.
ANNUAL SUBSCRIPTION, $6.00

RESEARCH APPARATUS

The Freas Sensitive Wat r Thermostat in regular use in the lea ing American and Canadian Universities and Colleges.

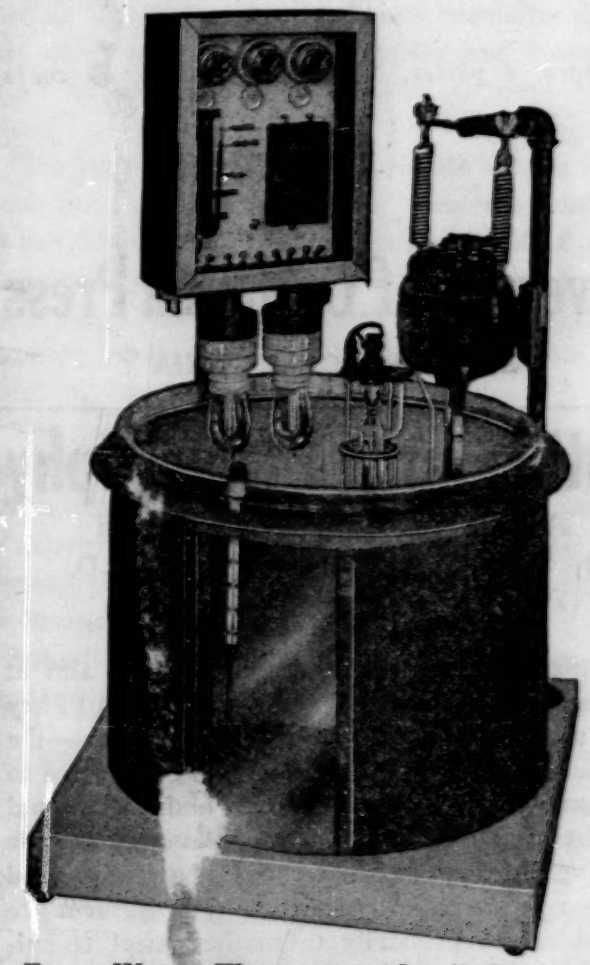
Designed to furnish continuous constant temperature from lowest temperature of water or water solution available up to 50° C. Large size is sensitive to 2/1000° C. Small size (see cut) is sensitive to 1/100° C. The large size has rectangular copper lined tank of 85 gallon capacity. The small size has round inner glass tank of 10 gallon capacity. Both sizes use the standard Freas sensitive mercury regulator.

Price of the large size_____$480.00
Price of the small size_____$220.00

For details of the large size thermostat, also of the Freas water bath, write for Bulletin "Freas Water Baths and Thermostats."

For details in regard to other forms of Freas apparatus we refer to the following bulletins:

Freas Conditioning Ovens; Freas Conductivity Apparatus; Freas Incubators and Sterilizers; Freas Ovens and Tube Furnaces; Freas Vacuum Ovens.



Freas Water Thermostat, Small Size

Any of these bulletins will be sent without charge on request, also information in regard to Freas Steam Hot Plate or Freas Hot Water Mixer

Eimer AND Amend
FOUNDED 51

NEW YORK CITY
3rd Ave., 18th—19th St.

PITTSBU.' BRANCH
4048 Jer Arcade

Washington, D. C. Display Room, Suite 601, Even ar Building,
Pennsylvania Avenue and 11th Str

KOFOID AND SWEZY

MITOSIS AND FISSION IN THE ACTIVE AND ENCYSTED PHASES OF GIARDIA ENTERICA (GRASSI) IN MAN

WITH A DISCUSSION OF THE METHOD OF ORIGIN OF BILATERAL SYMMETRY IN THE POLYMASTIGOTE FLAGELLATA

34 pages, 4 plates, 11 figures in text, 50 cents

University of California Press

BERKELEY, CALIFORNIA

FOR THE CHEMISTRY LIBRARY

HEALTH of the INDUSTRIAL WORKER
38 Illustrations. Cloth, $7.00. By E. L. COLLIS, M.D., MAJOR GREENWOOD, M.D., and other contributors (Eng.)

DISEASES of OCCUPATION and VOCATIONAL HYGIENE
Illustrated. Cloth, $10.00. By many writers; editors, G. M. KOBER, M.D., and W. C. HANSON, M.D.

PHILOSOPHY and the NEW PHYSICS
Cloth, $1.75. By PROF. L. ROUGIER (Paris) Translation by PROF. MASIUS (Worcester)

CHEMICAL REACTIONS and their EQUATIONS
Cloth, $1.75. By PROF. I. W. D. HACKH (San Francisco)

ORGANIC CHEMISTRY (English Edition)
Newly Translated and Revised.
Vol. I—The Aliphatic Series. Cloth, $7.00.
Vol. II—The Carbocyclic Series. (Pa't I) Cloth, $8.00
Vol. III—In Press.
By PROF. V. VON RICHTER (Breslau) Translated by PROF. PERCY E. SPEILMAN (Eng.)

TEXTBOOK of ORGANIC CHEMISTRY
Cloth, $4.00. By PROF. JOSEPH S. CHAMBERLAIN (Mass. Agric. Coll.)

PHYSICS and CHEMISTRY of COLLOIDS
4th Edition. Illustrated. Cloth, $2.25. By E. HATSCHEK (London)

P. BLAKISTON'S SON & CO., Phila.

Mathematical Philosophy

A Study of Fate and Freedom

By CASSIUS J. KEYSER, Ph. D., LL.D.
Adrain Professor of Mathematics, Columbia University

THESE "lectures for educated laymen" aim at democratizing science and scientific criticism. They show that the *greatest* of mathematical ideas—the pillar-concepts of the science—belong no more to mathematics than to *all* science and to rational thought in general. The great pillar-concepts are explained in the simplest terms. The reader need not be a mathematical specialist. The lectures are not addressed primarily to mathematical technicians. They are designed for students and teachers whether of mathematics or philosophy or engineering or psychology or logic or education or sociology or art or natural science and for all other students, thinkers and critics who own allegiance to the *laws of thought* and who desire to gain a fair understanding of the nature, the spirit, the standards and the bearings of the science which Plato called divine.

Price, $4.70

E. P. DUTTON & CO., Publishers
681 Fifth Avenue New York

Marine Biological Laboratory

Woods Hole, Mass.

INVESTIGATION
Entire Year
Facilities for research in Zoology, Embryology, Physiology, and Botany. Eighty-four private laboratories $100 each for not over three months. Thirty tables are available for beginners in research who desire to work under the direction of members of the staff. The fee for such a table is $50.00.

INSTRUCTION
June 28 to August 8, 1922
Courses of laboratory instruction with lectures are offered in Invertebrate Zoology, Protozoology, Embryology, Physiology and Morphology and Taxonomy of the Algae. Each course requires the full time of the student. Fee, $75. A lecture course on the Philosophical Aspects of Biology and Allied Sciences is also offered.

SUPPLY DEPARTMENT
Open the Entire Year

Animals and plants, preserved, living, and in embryonic stages. Preserved material of all types of animals and of Algae, Fungi, Liverworts and Mosses furnished for classwork, or for the museum. Living material furnished in season as ordered. Microscopic slides in Zoology, Botany, Histology, Bacteriology. Catalogues of Zoological and Botanical material and Microscopic Slides sent on application. State which is desired. For catalogues and all information regarding material, address.

GEO. M. GRAY,
Curator, Woods Hole, Mass.

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

SCIENCE

A Weekly Journal devoted to the Advancement of Science, publishing the official notices and proceedings of the American Association for the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

11 Liberty St., Utica, N. Y. Garrison, N. Y.

New York City: Grand Central Terminal

Single Copies, 15 Cts. Annual Subscription, $6.00

Entered as second-class matter January 21, 1922, at the Post Office at Utica, N. Y., under the Act of March 3, 1879.

VOL. LV MARCH 24, 1922 No. 1421

A National Policy for Agricultural Research: PRESIDENT RAYMOND A. PEARSON 229

The 1921 Expedition of the California Academy of Sciences to the Gulf of California: DR. G. DALLAS HANNA 305

Appeal of the American Chemical Society 307

Scientific Events:

An Institute of Hygiene in London; Co-operation between the Government and Industry in Standardization; Competitive Exhibition of Photographs of Mammals; Annual Meetings of the American Geophysical Union and its Sections; Lectures on Light and the Constitution of Matter 310

Scientific Notes and News 312

University and Educational Notes 316

Discussion and Correspondence:

The Vote on the Evolution Bill in the Kentucky Legislature: PROFESSOR ARTHUR N. MILLER. *Roteria:* DR. FREDERICK PALMER, JR. *The Value of Tilth in Agriculture:* L. S. FRIERSON 316

Quotations:

Proposed Legislation against the Teaching of Evolution 318

Scientific Books:

Stefansson's The Friendly Arctic: PROFESSOR RAYMOND PEARL 320

Special Articles:

Acoustic Topography in a Room: PROFESSOR CARL BARUS 321

Meetings of the Genetics Sections: PROFESSOR L. J. COLE 326

A NATIONAL POLICY FOR AGRICULTURAL RESEARCH[1]

THERE should be a well-defined national policy in reference to agricultural research because such research relates to questions of fundamental national importance and the value of such research to the whole nation has been proved; furthermore, agricultural problems affecting the national welfare are becoming more and more numerous and complex and research must be enlarged to enable us to cope with them.

The policy should be to provide ample support for the investigation of problems relating to the decrease of cost of producing farm products and their more efficient distribution and marketing, the improvement of their quality, the conservation of soil fertility and the betterment of rural life.

The policy also should be to encourage co-operation of all public agencies engaged in agricultural research, and to provide for proper supervision,—enough of each to produce the highest possible efficiency and not so much as to hamper efficiency.

Sound arguments in plenty can be given to support these statements.

THE IMPORTANCE OF AGRICULTURE AS A FUNDAMENTAL INDUSTRY

About forty per cent. of the population of our country is engaged in agriculture. There are nearly six and one-half million (6,448,366) farms, including nearly one billion (955,676,545) acres. Each farm is an independent unit, and the character of the homes on these farms has a profound influence on the character of our nation.

The value of farm lands is estimated to be over sixty-six billion dollars ($66,334,309,556).

[1] Read at the President's Conference on the Agricultural Situation, Washington, D. C., January 26, 1922.

The value of implements and machinery is estimated to exceed three and one-half billion dollars ($3,598,317,021). The estimated value of live stock is nearly eight billion dollars ($7,996,362,496). The total of these great investments is about seventy-eight billion dollars ($77,925,989,073).

The value of the annual production of our farms far exceeds that of any other industry. It is equivalent to the value of all manufactures over the costs of raw materials. The value of farm products exported from the United States has averaged over two billion dollars ($2,062,000,000) per year the past ten years and constituted an average of 44.4 per cent. of all domestic exports.

In brief, it is sufficient to say that agriculture is our largest industry; it furnishes practically all of our food, the material for all of our clothes, the raw material for the larger part of the manufacturing industries of the nation, about one-half of the gross earnings of the railroads of the country, a consumptive market for nearly one-half of all the manufactured products sold on our markets and, lastly, agriculture furnishes a constant stream of rugged people who quickly find positions of service in the great centers of population.

THE PRESENT ORGANIZATION FOR RESEARCH

Research has been applied to all phases of human activities but research in agriculture has been relatively late in development. It came with a growing concern for the future of agriculture,—an appreciation that as long as man lives agriculture must be a permanent industry and as population increases agriculture must be increasingly efficient.

The policy of encouraging agricultural research started in the states. Agricultural experiment stations were established in Connecticut and California as early as 1875, in North Carolina in 1877, and in fifteen other states prior to 1887 when the Hatch Act became effective. In 1906 the Adams law was passed. Those two laws are formal acknowledgement by Congress that agricultural research is an important national question. Under each of these laws every state receives $15,000 annually for agricultural research, making $1,440,000 from the Federal treasury. State appropriations for the same purpose amount to about three million dollars annually. Research work in the states stimulated similar work in the Federal Department of Agriculture which is now by far the largest single organization conducting agricultural research. This department gives attention principally to problems of national or regional character, and engages in cooperative research work with the State experiment stations to a large extent. It would be impracticable for the Federal department to care for all the problems pressing for solution and wisely that is not attempted. The states are in intimate contact with their own problems and so far as funds permit give these problems prompt and usually sufficient attention.

THE RESULTS OF AGRICULTURAL RESEARCH

The benefits of agricultural research are so well known that it is hardly necessary to mention them. For example: A farmer produced pork at a cost of forty-four cents per pound until he made use of information gained from research and then he reduced his cost to four cents per pound. Through instruction based upon research and widely disseminated to the farmers, one state has shown how to reduce losses from the Hessian fly to the extent of twenty million bushels of wheat in four years, —and all this at only a nominal expense. Research has made it possible to continue growing important crops in sections of the country where some pest or disease was turning the farmers' efforts to naught. About ten years ago the United States Senate showed that scientific research in the Department of Agriculture, costing about five million dollars annually, had resulted in saving about five hundred million dollars annually.

Books could be filled with interesting stories such as how the cause of wheat rust was discovered and a remedy applied and how Texas cattle fever was placed under control and is being surely eradicated and many other similar exploits. Add to all this the development of improvements of animals and plants and of agricultural methods generally.

Research is the foundation of our whole

system of agricultural education in colleges and schools, through the Extension Service, and through agricultural journals and books. It also is the basis for regulatory laws and their enforcement.

It would be impossible to tell what would be the situation in this country if agricultural research had not been maintained. We know some of the most important improved varieties of plants and some of the better strains of animals would be missing. Some diseases of animals and food plants would be rampant. Great areas of soil now producing crops would be barren, and the production from still larger areas would be lowered. Farmers would be paying more for their supplies and some highly effective marketing methods would not be known.

MORE RESEARCH IS NEEDED

It is unfortunate that the research agencies of the country are unable to keep pace with the demands being made upon them. The experience of the past, the present situation, and a view into the future emphasizes the necessity of enlarging the system. A sound and efficient agriculture calls for more research. The development of some phases of agriculture, representing millions of dollars to farmers and to other citizens, awaits the enlargement of research activities. As the country becomes older and its population increases and quicker transportation is developed, new problems constantly appear. Some persons who are not informed think we are doing quite well at the present time and agricultural research might be kept on its present basis or even it might take a vacation for a few years. But the germs and the fungi now on their way to favorable locations throughout the country will not pause on their journey, and plant food will continue to be depleted when crops continue to be taken from the soil.

Research problems might be divided into two great groups. The first would include the new difficulties that are constantly arising and must be overcome to keep agriculture in its present position, such as a new insect pest. The second would include such questions as the improvement of existing methods which means a better agriculture. Originally the second group of questions constituted most of the research work performed. More and more questions in the first group have been coming to the front in recent years until now they demand a very large part of the research resources.

New methods for reducing cost of production, the better distribution of farm products, and better methods of marketing are sorely needed at this time. This is in the interest of the average citizen who buys all his supplies, because such methods will help to reduce the cost of living. This is in the interest also of farmers because better methods will increase the profits of farming. Both benefits are worthwhile. But a chief reason for decreasing the cost of farm production is the importance of holding our position in the markets of the world. We ought to get a better hold upon those markets especially in so far as certain manufactured farm products are concerned. If we wish to sell to Great Britain at a profit we must be able to make a lower price than others can make. We used to export about one hundred forty million pounds of cheese annually, but before the Great War these exports had fallen to two or three million pounds. We like to say that we are not exporting cheese because our larger population is consuming it all. But why did not our cheese production increase with our population? The chief reason was that Canada could do better than we could do in making a favorable price on cheese in the English markets. The outcome of such competition depends largely upon the results of our research for superior and less expensive methods.

Our natural resources plus our skill plus our shipping ability are in competition with the natural resources of other countries plus their skill plus their shipping ability plus their cheaper labor which involves lower living standards. If we are to win from them we must depend chiefly upon our superior knowledge. Some other countries have as good natural resources as ours. Sometimes they are even better because of virgin lands. Other countries

have as favorable transportation. Most countries have cheaper labor. We must overcome their advantages by our knowledge which must be developed through research.

When we find an economy in feeding or some method of reducing cost per bushel or when we invent an improved harvester or perfect a silo, or when we find more direct and efficient methods of marketing, we are able to reduce our selling price and thus strengthen our hold on foreign markets. When we allow a mysterious disease or inefficient methods to increase the price we must ask whether we are losing our hold on foreign markets.

We must not forget that in other countries strenuous efforts also are being made to devise better methods through research in order to take the foreign markets away from us and even to invade our home markets. Thus far we have developed only a background of information regarding the great economic questions. We have hardly crossed the threshold in research concerning the adaptation of production to requirements and other such great economic problems.

Other vitally important subjects waiting to be studied as they deserve include the reforestation on farms and the betterment of rural life. There are many questions relating to the comfort and happiness of people who live in the country that are becoming constantly more acute. These include the whole sphere of the work of farm women. The failure to solve these questions is resulting in some of the best of type of farmers moving from the country to the city. Much needs to be done to show such people how to make country life as satisfactory as city life.

One other of many very important problems in need of research may be mentioned,—the conservation of soil fertility. This is the most important of our natural resources. It is easily removed but not easily replaced. We gather crops very much as we harvest lumber. Most people know how we have accomplished such an enormous production of lumber during the past few decades. We simply went into the forests which had required hundreds of years to grow and we took the trees that were wanted and even gave scant consideration to the welfare of other trees which might have become useful in later years. We have not considered how succeeding generations will get their lumber. We have proceeded on the basis that we might as well take it all. We point to our lumber kings as examples of great business ability. What will be said of them fifty years from now when the people of that day want lumber and find that the accumulated growth of centuries over large areas has been destroyed by our generation and even without much effort to start new trees for use in the future? Our cereal production has been carried along on about the same lines. If present practices continue this nation will awaken some day to the fact that we are more like arid Egypt or Babylon than the wonderful, fertile country that our historians tell us was discovered by Columbus.

Furthermore, we are allowing many square miles of good farm land each year to be washed away by our streams. This erosion supplemented by surface wash amounts to hundreds of millions of tons annually. These losses represent stupendous values which doubtless could be largely reduced through further research.

No one can tell what wonderful improvements in agriculture may be revealed in the future. We easily think of possible further advances along the lines we know about but these may be made secondary by other advances that we can not now even think of. Some persons believe that beneficial changes are yet to come in agriculture which are no less profound than the changes in transportation caused by the flying machine or in communication caused by the wireless telephone. Those two improvements are epoch making but were hardly within our range of thinking a generation ago.

I will not be so rash as to suggest that a tin Lizzie ever will give milk, but I will predict that some day power for the farm which now constitutes a chief item of expense will be obtained cheaply from the winds that blow over the farm. And with this cheap power I predict that some day we will produce the best of building materials, at lowest cost, from almost any soil. It may be aluminum.

I will predict also that if our plant and

animal experts are given reasonable support they will find, in good time, new and good foods now unknown, and if our economists and other experts are given reasonable support they will show how our cities may be assured of an abundant supply of farm products at all times and at cost reductions that will exceed previous cost reductions that have been so welcome to both farmer and consumer.

DEVELOPMENT OF A POLICY

We should no longer delay the development of a more comprehensive national policy for agricultural research. It should provide for liberal federal and state financial support. The best recent testimony comes from the Congressional Joint Commission of Agricultural Inquiry (Congressional Record, December 14, 1921, page 421). Members of this Commission after a long and thorough study report as follows:

"Agriculture is subject to special hazards resulting from the weather and climatic conditions, animal and plant diseases and insect pests. These hazards reduce farming to a gigantic gamble. But methods of production can be adapted to the end of reducing losses from climatic and weather conditions to the minimum. Plant and animal diseases and insect pests can, to a certain degree, be controlled. But the means and the method of reducing or controlling these hazards can not be worked out on the farm by the individual farmer. The investment even of the largest is not sufficient to permit the maintenance of the organization necessary for the study and formulation of these means and methods. A program of agricultural development therefore must include provisions for an expanded and coordinated program of practical scientific investigation, through State and National departments of agriculture and through agricultural colleges and universities, directed toward reducing the hazards of climatic and weather conditions and of plant and animal diseases and insect pests."

One strong reason for using public funds to support agricultural research is that the knowledge to be derived should be made available to every farmer throughout the country who wants it. It should never happen in this country that knowledge relating to agricultural production shall be limited in its application to private interests because it was developed at the expense of those interests. It may not be improper in other lines of business for individuals or concerns to have a monopoly on knowledge and thus enable them to develop a business monopoly. But this should never be possible in agriculture. A cornerstone of our national strength is the independent farm families who are able to maintain themselves on an independent basis because every farmer is entitled to know all of the secrets of his business that anyone knows.

APPRECIATION OF AGRICULTURAL RESEARCH

(1) What should be insured first in a national policy? Agricultural research needs first of all the appreciation and good will of the public. Until this is given the research will be heavily handicapped.

Secretary of Agriculture Wallace declares that research is the basic work of his department and it is research that little by little is crystallized into agricultural progress. The public should get this idea. The Congress and legislatures should have it. An intelligent appreciation of agricultural research, especially among leaders and public men, a genuine respect for it, an understanding of its importance and its requirements, are the primary essentials in developing an effective national policy. Such an appreciation exists today but in a very restricted sense. Belief in the importance of research is too much of an abstract character, an acknowledgement that it is useful in a general way, an acceptance of the fact that it is desirable, but without real sympathy for it or understanding of its requirements. Thus the public fails to demand it in order that the nation's interests may benefit. One thoughtful student gives as one of the reasons for advocating national support for agricultural research the fact that national appreciation needs the stimulus of direct interest which comes with the discussion of the subject in the halls of Congress and the making of an appropriation. There are, however, other and better arguments.

An intelligent appreciation of agricultural

research is not evidenced in any large way by the recent action of Congress, let us say a very few members of Congress, by which the publication of two periodicals in the interest of agricultural research was suddenly ordered discontinued along with a lot of other publications of questionable value, most of which had developed during or soon after the war period. There is encouragement in the fact that some leading members of Congress were not informed as to what was occurring but now realize that a serious mistake has been made and are ready to help correct it.

ESSENTIALS FOR RESEARCH

Well trained men and ample funds are the essentials for research. It should be a national policy to train and encourage in every way possible the right kind of men and women and to supply funds to meet their reasonable needs in research work in the interest of agriculture.

(2) Efforts should be made always to encourage young men and women who have ability and inclination of the right kind, to prepare themselves for research work. Special scholarships and fellowships should be provided by the agricultural educational institutions to enable such persons to complete their fundamental training and later assistantships should be provided to bring them into helpful contact with older and well trained investigators and due credit should be allowed for their own efforts. As they advance in ability and in getting worthwhile results their compensation should be reasonably increased. Care should be taken to make this compensation as attractive as is provided for persons of corresponding ability and service in allied lines of work. Failure in this respect in recent years has resulted in heavy losses from the ranks of research workers in the Department of Agriculture and in State experiment stations. During a period of about six years, including the war, there was a change of nearly eighty per cent. in the scientific personnel engaged in agricultural research throughout the country. Many of the younger men went into war service, but the greater losses to agricultural research came from the resignation of older men who took other more renumerative positions. The overturn has been exceedingly large since the war. On this account, and without reflection upon those who have continued in research work or who have recently gone into that work, it must be admitted that research to-day, instead of being the strongest link in the chain made up of research, college education, and extension work, is the weakest link. Research is the least able of the three to meet the demands it should care for.

Funds for the support of agricultural research as now available represent such a small percentage of the interests concerned that they are almost negligible by comparison. They represent a much smaller per cent. of value of output than is so expended by many a manufacturing plant in the interest of its output.

(3) A principal requirement as to funds is assurance of permanent income. Without such assurance strong men can not be induced to prepare themselves adequately for research nor can they be retained in this work. Too often it has been necessary to stop important experimental work because of failure to continue appropriations. No one can tell what losses have been suffered because important projects after being conducted for an extended period of time had to be discontinued with the failure of appropriations before the final results had been secured.

(4) As agricultural research relates in such large measure to national problems, and the work done in one state is of value in many states and as agriculture is such a large factor in all business, it is right that national funds should be used in promoting agricultural research in the different states. A precedent has been furnished, and a national policy for agricultural research should provide for enlarging these national appropriations by small increments for a few years until they have reached amounts commensurate with present demands, as specified in the Purnell Bill, which would provide fifteen thousand dollars annually additional to each state for experiment station work and an additional ten thousand each year until the amount is eighty-five thousand dollars. These appropriations would be equivalent at the start to less than one cent per capita per year and would finally increase to about

four cents per capita. This measure, or other similar relief, should be enacted as soon as possible. It is preferable from the standpoint of efficiency to make the appropriation with the fewest possible conditions, as was done in the Hatch and Adams Acts, rather than to continue the requirement for offset funds, as provided in the Smith-Lever and Smith-Hughes Acts. As compared with the Federal government it seems that the states now are carrying their full share.

In considering appropriations for agricultural research it is well to remember that when our taxes are increased for this purpose our involuntary taxes, or those which are levied by powers beyond our control, are decreased many times more than the voluntary taxes are increased.

COOPERATION AND SUPERVISION

(5) A national policy fostering agricultural research should provide for more definite and constructive cooperation by research agencies than now obtains.

(6) It must provide also for certain supervision to assure the proper use of public funds, and this is expected and welcomed. A reasonable amount of cooperation and supervision is stimulating. An excess is deadening.

(7) A more definite agreement on the fields to be occupied by the Department of Agriculture on the one hand and by the State experiment stations on the other hand, with better coordination of work and a larger provision for joint effort, should form a part of the policy for further developing agricultural research. Such a definition of function and joint effort would guard against undesirable duplication and would result in better directed efforts. Details should be worked out by representatives of the Secretary of Agriculture and the agricultural colleges and when properly approved should form a fundamental law. Once each year this joint agreement should be considered by duly chosen representatives for the purpose of making it more perfect. Among other things, it should provide for the wise selection of projects for investigation and for inviting experiment stations in different states or the Federal Department of Agriculture to give attention to different phases of a project requiring investigation at different places. All projects should be briefly but clearly described and recorded in the Department of Agriculture at Washington and all interested persons should be informed as to the kinds of work in progress. From time to time, at least once a year, the progress of each project should be officially reported and checked. When a project is undertaken, work on it should continue to a reasonable extent until it is finished or formally set aside, and care should be taken not to provide for starting new projects for any laboratory or station when it has too many projects unfinished.

(8) While a national policy for agricultural research should not enter the details of local administration, it should encourage the types of organization which would be most efficient.

SHALL WE HAVE AMPLE AGRICULTURAL RESEARCH?

An effort has been made to suggest a picture of our country as it would be without properly supported agricultural research, and again with such research. If this work is properly developed, agriculture will continue on a permanent and profitable basis in the face of ever increasing obstacles. And this nation with a strong agriculture will continue to furnish its own great commodities which come from the farms and will profit further from large sales of the surplus in other countries. The time is ripe for stimulating a national policy for agricultural research which will contribute to this great end.

RAYMOND A. PEARSON
IOWA STATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS

THE 1921 EXPEDITION OF THE CALIFORNIA ACADEMY OF SCIENCES TO THE GULF OF CALIFORNIA

IN the spring of 1921 the California Academy of Sciences sent a well-equipped scientific expedition to the Gulf of California. The purpose of the expedition was primarily to make as thorough study as possible of the fauna and flora of the islands in the Gulf and of certain important localities on

the adjacent mainland of Sonora and Baja California, and to make collections of research and museum materials in the various departments of zoology, botany and geology.

While several scientific expeditions have in the past visited the peninsula of Lower California, little attention has been given to the islands in the Gulf, of which the Coast Survey charts name about 30; in addition to these there are several rocks or small islets unnamed or not shown. Only five of these islands have more or less permanent inhabitants. Tiburon, the largest, is the home, for a portion of each year of the Seri or Koonkat Indians who visit it for hunting and fishing. San Marcos, Ceralbo, Carmen and San José are the locations of various industrial plants of some little importance; practically all islands of any considerable size are visited now and then by prospectors of various sorts. Some of the islands have become known because of the presence of salt beds, others because of guano deposits of considerable value; and these last with still others are the breeding grounds of vast numbers of sea birds. Visits of scientific men to these islands have been few and brief. Enough was known, however, to justify the belief that a careful exploration would yield collections and knowledge that would prove of great popular interest as well as scientific value.

The scientific staff of the expedition consisted of the following: Joseph R. Slevin, herpetologist, in charge; Edward P. Van Duzee, entomologist; Dr. Fred Baker, conchologist, paleontologist and physician; Ivan M. Johnston, botanist; Virgil W. Owen, ornithologist and mammalogist; and Joseph C. Chamberlin, general assistant. In addition to the Academy representatives, the expedition was fortunate in having two collaborators from the Mexican government, Señor Francisco Contreras, director and conchologist, and Señor Carlos Lopez, chief taxidermist of the Museo Nacional de Mexico.

The Academy chartered the gasoline schooner *Silver Gate*, 64 feet 6 inches over-all, 15 feet beam, 9 feet draft when loaded, 22 tons net, cruising radius 2,000 miles, and capable of making 8 knots per hour. The vessel was in command of Captain John Ross whose intimate acquaintance with the Gulf and its islands was of very great help to the expedition.

The issuance of the permits for exportation from the United States of the firearms and the alcohol necessary for the collecting and preservation of specimens was most exasperatingly delayed at Washington, and it was not until Honorable Julius Kahn and the Secretary of State were appealed to that action was gotten. Mr. Kahn secured the waiving of certain formalities and the necessary permits were issued. The Mexican government very promptly granted authority to the Academy to bring into Mexico the necessary equipment and to carry on the desired investigations in Mexican territory.

The various members of the party joined the *Silver Gate* at Guaymas, from which place the expedition set sail April 16.

The total number of days spent in the field was 87, and the number of miles cruised was 1811. Thirty-seven different islands were visited, some of them more than once. In addition to these, 14 stations were made on the coast of Lower California, and five on the coast of Sonora. Altogether, 96 collecting stations were occupied.

The Gulf of California is celebrated for its sudden and violent gales, but the itinerary of the *Silver Gate* was arranged with this in mind; with the results that no severe gales were encountered, no time was lost on account of adverse weather conditions, and the work was carried out essentially as originally planned.

The scientific results of the expedition are very satisfactory. Unusually large collections were made in most of the groups.

In entomology, more than 13,000 specimens were secured, a remarkable result when the arid, volcanic character of the country is considered and the further fact that the collecting was done at the close of the dry season when insects are fewer than at any other time. The collection of spiders, pseudoscorpions and myriopods secured by Mr. Chamberlin is particularly complete and valuable.

Perhaps the most remarkable collection of

all is that of reptiles and amphibians secured by Mr. Slevin, totaling more than 3,000 specimens. Every species previously known from the islands is represented by one or more specimens, and several species new to science were secured.

Very large and complete collections of the botany of the islands were secured by Mr. Johnston. In addition to a large number of dried specimens secured for the Academy's rapidly growing herbarium, a considerable number of living cactuses were sent direct to Dr. J. N. Rose at the United States National Museum, who with Dr. Britton, is monographing that group.

Owing to the unfortunate illness of Mr. Owen, during much of the cruise the collections of birds and mammals are small; however, good series of eggs of several species of birds were secured, particularly of Heermann's gull, and elegant and royal terns.

Dr. Baker secured a very extensive collection of mollusks particularly of shallow-water species. As the vessel was not equipped for dredging in deep water, not much was done in that line. Valuable collections of fossils were obtained at several places where fossils had not been previously known to exist. Dr. Baker also rendered invaluable service in his capacity as physician to the expedition. Through his constant attention to the drinking water supply, the food, and all other matters pertaining to health conditions on the ship, no serious illness due to local conditions appeared at any time.

A record of water temperatures was kept throughout the cruise and samples of water were taken, all of which have been turned over to the Scripps Institution for Biological Research for use in its oceanographic studies.

Small collections of marine algæ, freshwater fishes, and marine invertebrates were made.

All of the collections have now arrived at the Academy's Museum in San Francisco. Specialists are already at work upon them and the results of their studies will appear in due time in the Proceedings of the California Academy of Sciences.

Mr. Slevin as chief of party performed his duties with excellent judgment and rare tact. All members of the staff showed a fine spirit of cooperation and a degree of enthusiasm and industry highly commendable. Collaborators Contreras and Lopez proved most agreeable and helpful members of the party and contributed materially to the success of the expedition. Through their relations with local officials of the Mexican government they were able to render very great assistance in many ways. Captain Ross was an ideal commanding officer who appreciated the aims and purposes of the expedition, and was always ready to do anything possible that would contribute to its success.

The uniform courtesy shown by local government officials was very gratifying and was highly appreciated by all members of the expedition, as it is by the Academy.

Special mention should be made of courtesies extended by the United States officials with whom the members of the party came in contact, particularly Mr. J. A. McPherson, United States Vice-Consul at Guaymas and Mr. Francis J. Dyer, United States Consul at Nogales, Sonora.

On the whole, the expedition is regarded by the Academy as having been a very successful one, the results of which when published will add much to the knowledge of the natural history of the region.

G. DALLAS HANNA
CALIFORNIA ACADEMY OF SCIENCES

APPEAL OF THE AMERICAN CHEMICAL SOCIETY

A SMALL group of chemists, gathered together in 1876, founded the American Chemical Society. For several years the society was localized in its nature. Its journals were of little scientific importance, and its membership grew slowly. At least twenty-five years passed before it gained strength. Its growth really started when it eliminated classes of membership, became a democratic organization, and interested chemists throughout the country. As its membership began to increase, its one journal, the *Journal of the American Chemical*

Society, took on character and standing. Members came in rapidly so that in 1907 the society had accumulated a slight surplus and felt it could branch out in the publication of a second journal, *Chemical Abstracts,* for which there was a decided need. With the publication of *Chemical Abstracts* chemists realized that the American Chemical Society was to be the central organization for chemistry in America and was interested solely in the advancement of American chemistry and the welfare of American chemists. With increasing numbers its income grew and in 1909 it was able to satisfy another crying need by publication of the *Journal of Industrial and Engineering Chemistry.* The increasing activities of the society so pleased the chemists of America that new members continued to join the society, and the society grew. With numbers its income further increased, and it was able to spend more money on its varied activities and improve the quality and size of its journals. More money was spent on its general meetings and more money was returned to its local sections for activity throughout the country.

With the war came added duties. Its president and council placed the society at the disposal of the government and through its efforts over 4,000 chemists were enrolled, as such, in uniform for chemical work during the war. At the same time practically all of its membership, in uniform and out, was engaged directly or indirectly in war work.

Up to this time the literature of the American Chemical Society had had for its main object the enlightenment of chemists. During the war it became apparent that it was extremely important that correct chemical information be also furnished to the public through the daily press and the *News Service* was organized. A year later in order to foster the growth of chemical literature in English the American Chemical Society established its series of *Chemical Monographs,* both scientific and technological, and assigned a paid editor to each. Again the society induced the Research Council, with the society's support, to enter upon the compilation and publication of *Critical Tables of Chemical and Physical Constants.* In 1917 the society published, at a cost of approximately $40,000, a *Decennial Index to Chemical Abstracts* and in 1920 entered upon the publication of an annual formula index to *Chemical Abstracts.*

The inception and continuation of each of these activities was made possible only by the increased number of chemists supporting the American Chemical Society and its resultant increase in income. Each was inexpensive in its infancy but with growth increased in cost. This growth is made apparent by the following table:

	1907	1921
Membership	3,400	15,000
Jour. Amer. Chem. Society, Cost	$ 6,752.18	$ 48,000.00
Chemical Abstracts, Cost	12,668.05	100,000.00
Jour. Indus. and Eng. Chem., Cost (1909)	7,478.70	82,000.00
A. C. S. News Service, Cost (1919)	2,069.88	13,000.00
Chemical Monographs, Cost		2,150.00
Local Sections, Cost	2,323.63	9,792.69
Total society expenditures, Cost	27,248.89	325,000.00

The society's success has been due to its democratic organization; to the fact that every member has an equal voice in its affairs; to its form of government; to its sixty local sections, patterned after our national government, each electing representatives to the governing body; to the easy removal and constant rotation of its officers and representatives; to the high character of its publications; but chiefly to the fact that through numbers it has been able to accomplish results and return to its membership much more for each dollar individually expended than can be shown by any other technical society in any country in the world. According to the treasurer's report published in 1921 the expenditure per member for 1920 was as follows:

Journal	$ 3.23
Abstracts	5.84
Industrial Journal	4.84
News Service	.57
Local Sections	.55
Secretary's Office	1.43
Treasurer's Office	.22
President's Office	.02
General Meetings	.12
Monographs	.15
Miscellaneous	.07
Total	$17.04

The total expenditure of several hundred thousand dollars was made possible simply by the size of the membership. The success of the society was due first to the character of its work and second to the fact that it has more technical men, representing one profession, gathered together and working together for the development of their profession than any other society in the world.

All members will appreciate the necessity of a high quality of work but will not appreciate without explanation the need of large numbers working as a unit. This is, however, easily shown. With numbers the society can increase its output chiefly for the reason that every additional member helps diminish the overhead per individual. The journals must be published, and it costs just as much for editorial office and composition whether the publication is distributed to one or twenty thousand individuals. It is only because the members of the American Chemical Society take all three journals that it is possible to publish them at all, for the cost of "putting on the press" is by far the larger part of the cost of publication. Each additional copy is printed at a comparatively small additional cost. Accordingly, every additional member adds just so much to the surplus which the society has to spend. The return which the American Chemical Society gives to its members is the envy of other organizations throughout the world and is constantly referred to as a model of efficiency.

This data is sent to you to impress you with your individual responsibility if you wish the work of the American Chemical Society to continue and its influence for the development and continuation of chemical science and chemical industry to increase. It is the duty of every member to stand by and do his part not simply by the continued payment of his annual portion and by personal activity in the affairs of the society itself, but he should especially endeavor to impress the 10,000 individuals still in America who should be, but who are not, supporting its work. If this additional 10,000 would join with the 15,000 we now have, the activities of the American Chemical Society could be more than doubled. Few of the 10,000 realize the fact that they are carrying no part of the burden and are shirking their duty to the profession. By not associating themselves with the movement, they are not only enjoying the results of the labors of others, but also, are actually retarding the progress of the profession through which they are supposed to gain their livelihood. There is not a chemist in America that cannot afford to support the work of the American Chemical Society. In fact, there is not a chemist in America that would not gain financially in dollars and cents if he, as an individual, attended regularly the meetings of his local section and the general meetings of the society in order to rub shoulders with his fellows; to keep in touch with his profession and to rid himself of the effect of professional solitude from which too many of our American chemists suffer to-day. He would gain much inspiration; he would learn himself and transmit knowledge to others; he would increase in aptitude and in spirit; and from continued professional contact with other chemists he would acquire a viewpoint toward life which would be sure to return to him much more than the amount expended.

Until 1921, the curve of membership, the curve of expenditure, and the curve of profitable chemical output within the American Chemical Society went steadily upward. In 1921 the severest depression in chemistry took place that has ever befallen our country. The membership has, accordingly, somewhat declined, although by far the majority of the members have stood by, some at real personal sacrifice. The decrease in membership, in spite of conditions, has been only between 6 and 7 per cent. This decline in numbers has, however, immediately made itself felt in the society's ability to turn out productive work. As a result, the directors at their recent meeting were forced, much against their will and in face of an increased demand for space, to reduce the pages of each one of our three journals by 10 per cent., to decrease the activities of the *News Service* by a still larger percentage, and to discontinue the publication of the formula index of *Chemical Abstracts*. If the membership falls off further with the continued industrial depression, other activities of the society will also have to be retrenched. It, therefore, be-

hooves every member of the society, if he wishes for a recovery of chemical activity in our country, not only to himself continue to support the work of the society through the period of depression, which is sure to be temporary, but also to see that every other reputable person in America interested in chemistry comes into the society to give it new life, new vigor and increased resources.

SCIENTIFIC EVENTS

AN INSTITUTE OF HYGIENE IN LONDON[1]

IT has been known for some time that the Rockefeller Foundation has been seriously considering the recommendation for the establishment of an Institute of Hygiene, contained in the report of the post-graduate medical committee published last May (the Athlone committee). The recommendation was that an Institute of State Medicine should be established in London with well equipped laboratories and an efficient staff. It was further recommended that the institute should also provide instruction in other directions, including courses in forensic medicine, toxicology and industrial medicine.

These recommendations were considered by an expert committee, with the minister of health as chairman. In view of the difficulty at present of financing the scheme, the whole case was put before the Rockefeller Foundation as one in which they might think it well to cooperate in the general interest of progress in public health.

The minister of health has announced that the Rockefeller Foundation have offered to provide a sum of two million dollars towards the cost of building and equipping an Institute or School of Hygiene in London, on the understanding that the British Government accept the responsibility of providing for the staffing and maintenance of the school when it is established. This generous offer has been accepted by the minister of health on behalf of the government.

Hygiene, like other departments of medicine, knows no boundaries. In that sense this fine gift is made for the benefit of international medicine, but this country is grateful to the Rockefeller Foundation that it should have been selected. The Athlone committee estimated that the cost of maintaining an Institute of State Medicine would be about £10,000 a year. The scale on which the Rockefeller gift will make it possible to establish the Institute of Hygiene (it amounts at the present rate of exchange to over £400,000) will call for a larger expenditure for staff and maintenance; we have heard it estimated at £25,000 a year. Those familiar with the Athlone report will remember that it proposed to associate the institute with the University of London. This recommendation, it would appear, is not to be carried out, and the annual expenditure will therefore not come out of moneys at the disposal of the university grants committee, but will be found by a special vote of Parliament. The intention is, we believe, that the Institute of Hygiene shall be administered by a mixed committee, representing the various bodies interested, for it is to be remembered that London already possesses certain important elements of an institute of hygiene.

[1] From the *British Medical Journal*.

COOPERATION BETWEEN THE GOVERNMENT AND INDUSTRY IN STANDARDIZATION

At the request of the Honorable Herbert C. Hoover, secretary of commerce, the American Engineering Standards Committee has designated Mr. A. A. Stevenson, the retiring chairman of the committee, as a special representative to work with the department in the cooperation between its division of simplified practice and the American Engineering Standards Committee.

The division of simplified practice is a coordinating unit of the Department of Commerce assisting in those reductions of excessive variety and other simplifications which many industries are undertaking in order to decrease the cost of production and distribution of manufactured articles. The work of the division was organized in the latter part of 1921 and is now actively under way.

The American Engineering Standards Committee, which serves as a national clearing house for a broad field of engineering and

industrial standardization, has offered Secretary Hoover the use of its machinery in carrying out the detailed work on technical projects initiated in the simplification program of the Department of Commerce. The committee hopes to be of great value to Mr. Hoover in this simplification program of the department. It was as a result of this hope that the designation of Mr. Stevenson as a representative came about.

The American Engineering Standards Committee has been actively at work somewhat over two years, during which time it has brought about a large measure of industry-wide cooperation. In this work more than a hundred national organizations are participating through representatives officially designated by them. The formulation of the standard for each specific project is in the hands of a working committee made up of representatives officially designated by the various bodies concerned. Eighteen standards have received formal approval as nationally recognized standards, and work on more than sixty other projects is in various stages of development. The committee is maintained jointly by twenty-nine national organizations, including five departments of the federal government, nine national engineering societies, and fifteen national industrial associations.

There are now similar national industrial standardizing bodies in thirteen foreign countries, all but one of which were formed during or since the war. Of these the British and the German work is the most extensive, but active and important work is going forward in other countries.

COMPETITIVE EXHIBITION OF PHOTOGRAPHS OF MAMMALS AT THE AMERICAN MUSEUM OF NATURAL HISTORY

THE American Museum of Natural History plans to hold a competitive exhibition of photographs of mammals at the time of the annual meeting of the American Society of Mammalogists. These photographs will be exhibited in the halls of the museum and all entries must be made on or before May 10. These photographs will be on exhibition to the general public for one month. Prizes will be offered for the best photographs, and the conditions of entry are as set forth below:

1. Only such photographs will be accepted for exhibition as are deemed suitable by the committee.

2. Photographs will be exhibited and judged under two categories: *first,* photographs of mammals in the wild state; *second,* photographs of mammals in captivity. Photographs of domestic mammas are not desired.

3. The American Society of Mammalogists will be asked to select the judges who will award the prizes.

4. Photographs may be of any size, but they should be affixed to cardboard or paper mat, preferably gray. No photograph should be sent unmounted. Contestants may submit any number of photographs.

5. The installation of the exhibition will be done by the museum, and all entries will be returned, postpaid, if desired by the exhibitor. The museum, however, would be pleased to accept for its files any photographs of especial interest. While the museum will exercise every possible care of the material exhibited, it does not assume any responsibility for loss or damage.

6. Cash prizes will be awarded as follows: for the best photographs of mammals in the wild state: First prize, $100; second prize, $60; third prize, $40; for the best photographs of mammals in capitivity: First prize, $50; second prize, $30; third prize, $20. A certificate of honorable mention will be awarded to not more than five additional exhibitors in each category.

Committee on exhibition: H. E. Anthony, Herbert Lang, Robert C. Murphy, G. Clyde Fisher.

ANNUAL MEETINGS OF THE AMERICAN GEOPHYSICAL UNION AND ITS SECTIONS

THE American Geophysical Union and its several sections met, March 6-8, at the offices of the National Research Council, Washington, D. C., to hear reports of committees, to consider the agenda for the meetings in Rome, May, 1922, of the International Geodetic and

Geophysical Union, and to elect officers. The meetings were well attended and several of the sections reported gratifying progress in their respective fields.

The delegates selected to represent the Union and its sections at the Rome meetings are:

Geodesy: Wm. Bowie, United States Coast and Geodetic Survey, Washington, D. C.

Seismology: Harry Fielding Reid, Johns Hopkins University, Baltimore, Md.

Meteorology: H. H. Kimball, United States Weather Bureau, Washington, D. C.

Terrestrial Magnetism and Atmospheric Electricity: L. A. Bauer, Carnegie Institution, Washington, D. C.

Physical Oceanography: G. W. Littlehales, Hydrographic Office, Washington, D. C.

Volcanology: H. S. Washington, Geophysical Laboratory, Washington, D. C.

The officers, as of July 1, 1922, are:

The Union: L. A. Bauer, *chairman;* A. L. Day, *vice-chairman;* Wm. Bowie, *secretary.*

Geodesy: John F. Hayford, *chairman;* R. L. Faris, *vice-chairman;* N. L. Bowen, *secretary.*

Seismology: W. J. Humphreys, *chairman;* J. B. Woodworth, *vice-chairman;* D. L. Hazard, *secretary.*

Meteorology: E. H. Bowie, *chairman;* R. DeC. Ward, *vice-chairman;* A. J. Henry, *secretary.*

Terrestrial Magnetism and Atmospheric Electricity: W. F. G. Swann, *chairman;* L. A. Bauer, *vice-chairman;* J. A. Fleming, *secretary.*

Physical Oceanography: J. P. Ault, *chairman;* G. W. Littlehales, *vice-chairman;* W. E. Parker, *secretary.*

Volcanology: L. H. Adams, *chairman;* T. A. Jaggar, *vice-chairman;* R. B. Sosman, *secretary.*

Geophysical Chemistry: H. S. Washington, *chairman;* Whitman Cross, *vice-chairman;* R. B. Sosman, *secretary.*

W. J. HUMPHREYS,
Secretary for the Union

LECTURES ON LIGHT AND THE CONSTITUTION OF MATTER AT THE UNIVERSITY OF WISCONSIN

PROFESSOR H. A. LORENTZ, of Leiden, Holland, is delivering a series of four lectures on the general subject of Light and the Constitution of Matter at the University of Wisconsin from March 20 to 27. Following the lectures, on March 30, 31, and April 1, a colloquium, on the "Fundamental concepts of electro-dynamics and of the electron theory," will be held in his honor. As shown in the following program, the papers presented will summarize the present status in various fields with especial reference to the unsolved problems and the relation between theory and experiment. Dr. Lorentz will respond to each, and general discussion will be invited. The university extends a cordial invitations to attend both the lectures and the colloquium to all persons interested.

Program:

THURSDAY, MARCH 30

The experimental basis for the laws of electro-dynamic action: W. F. G. SWANN, University of Minnesota.

Astrophysical evidence concerning radiant energy: HARLOW SHAPLEY, Harvard Observatory.

Deduction of the laws of electro-dynamics from the relativity principle: LEIGH PAGE, Yale University.

Analytical formulation of electro-magnetic theory through the field concept: MAX MASON, University of Wisconsin.

FRIDAY, MARCH 31

The rotating earth as a reference system for light propagation: L. SILBERSTEIN, Research Laboratory, Eastman Kodak Company.

Application of statistical mechanics to electron theory: A. C. LUNN, University of Chicago.

Scattering of light and resonance radiation in relation to optical theories: R. W. WOOD, Johns Hopkins University.

Thermal radiation,—a discussion of recent experimental results: C. E. MENDENHALL, University of Wisconsin.

SATURDAY, APRIL 1

Electron theory of metals, volume phenomena: P. W. BRIDGMAN, Harvard University.

Electron theory of metals, surface phenomena: K. T. COMPTON, Princeton University.

SCIENTIFIC NOTES AND NEWS

DR. FRANK SCHLESINGER, director of the Yale Observatory, has been elected chairman of the American delegation to the meeting of the International Astronomical Union that opens at Rome on May 2. Other members of the delegation are Messrs. Aitken, Curtis, Lee, Miller, Russell, St. John, Seares and Shapley.

DR. H. FOSTER BAIN, director of the Bureau

of Mines, was elected president of the Joseph A. Holmes Safety Association at its annual meeting at Washington, D. C., last week. Dr. Charles D. Walcott, secretary of the Smithsonian Institution, was named first vice-president, and Mr. Samuel Gompers, president of the American Federation of Labor, second vice-president. Mr. George S. Rice, chief mining engineer of the bureau, and Mr. James Lord, of the mining department of the American Federation of Labor, were elected directors.

WILLIAM M. CORSE, general manager of the Monel Metal Corporation, will take active charge of the division of research extension of The National Research Council on April 1, succeeding Dr. H. E. Howe, now editor of *The Journal of Industrial and Engineering Chemistry*.

O. M. BUTLER has resigned his position as assistant director of The Forest Products Laboratory, in order to accept the position of director of technical activities of the American Forestry Association.

THE nominating committee of the Harvard Alumni Association has selected Dr. William Sidney Thayer, Baltimore, former president of the Association of American Physicians, and Dr. Herbert Charles Moffitt, San Francisco, professor of medicine, University of California, as candidates for the Harvard board of overseers.

MRS. ANNA BOTSFORD COMSTOCK, who retired in September from a professorship of entomology at Cornell University, has been nominated for election as alumni trustee.

THE University of London labor party has adopted as its parliamentary candidate, Dr. W. H. R. Rivers, F. R. S., praelector in natural science, St. John's College, Cambridge. Mr. Sidney Webb, the candidate at the last election, who is standing for another constituency, proposed the adoption of Dr. Rivers, and among those who spoke in his support was Sir Arthur Newsholme, who described Dr. Rivers as the most advanced and original anthropologist in England.

PROFESSOR F. G. HOPKINS and Dr. W. H. R. Rivers have been elected members of the Athenæum Club for "distinguished eminence in science."

DR. WOLFGANG KÖHLER has been appointed director of the Berlin Psychological Laboratory, to fill the vacancy caused by the retirement of Professor Stumpf.

PROFESSOR W. W. WATTS, F. R. S., has been appointed representative of the University of London at the International Geographical Congress to be held in Brussels next August.

DR. A. W. PORTER, D. Sc., F. R. S., has been appointed a member of the council of the British Photographic Research Association.

FRANK R. ELDRED, for many years chief chemist and director of the scientific division of Eli Lilly and Company, and Frederick C. Atkinson, chemical director of the American Hominy Company, have organized the firm of Eldred and Atkinson, consulting chemists and engineers, with offices in New York City.

DR. CHARLES A. CULVER, formerly in charge of the physics department of Beloit College, Wisconsin, was recently elected president of the Radio Research Club of Canada.

THE Board of Regents of the University of Minnesota have granted Professor F. L. Washburn, of the division of entomology and zoology, a six months' sabbatical furlough to collect insects in certain islands of Polynesia. Expenses of the trip are not paid by the university, but are provided for through private funds and interest in the work on the part of a group of business and professional men in Minneapolis. Mr. Washburn will make collections on Tahiti, Murea, probably the Marquesans and possibly in the Cook group. The collection will be the property of the university.

DR. FRANCIS W. PEABODY, assistant professor of medicine at Harvard University, who was recently appointed director of the Thorndike Memorial Institute, who has been acting in an advisory capacity and holding clinics for the department of medicine of the Peking Union Medical College during the first tri-

mester, has left for home. On his way back, he will visit the medical schools of the Shantung Christian University at Tsi-nen-fu and of the Yale-in-China mission at Changsha.

DR. WILLIAM BOWIE gave recently two lectures to the students of Lehigh University; one was on the subject of "isostasy" for the geological students, and the other "the work of the Coast and Geodetic Survey" before the students' civil engineering society.

PROFESSOR G. ELLIOT SMITH recently delivered the Montgomery lecture before the Royal College of Surgeons of Ireland on the "Influence of Vision in the Development of Man's Intellectual Powers." Professor Smith also lectured to the Royal Zoological Society of Ireland on "Our Rude Ancestors."

ON March 2, Professor H. M. Lefroy delivered the first of two lectures at the Royal Institution on (I) "The Menace of the Insect Pest" and (II) "The Balance of Life in Relation to Insect Pest Control." On March 4, Sir Ernest Rutherford began a course of six lectures on "Radio activity."

AT the meeting of the Royal Society, held on March 9, the Bakerian lecture was delivered by Professor T. R. Merton and Mr. S. Barratt. The lecture was entitled "The Spectrum of Hydrogen."

THE British Institution of Electrical Engineers began the celebration of its jubilee on February 21, when at its house on the Victoria Embankment Professor J. A. Fleming gave a lecture on "Michael Faraday and the Foundations of Electrical Engineering." Many of Faraday's original experiments were repeated, and on the lecture table were some of the original apparatus he employed, lent by the Royal Institution, where all his work was done. The Science Museum at South Kensington also lent models and examples of early electrical machines.

DR. CHARLES W. WAIDNER, chief physicist of the Bureau of Standards, known for his studies of temperatures and heat measurements, died at his home in Washington on March 11.

BOYNTON WELLS MCFARLAND, assistant professor of chemistry at Yale University, died at his home in New Haven on Monday, March 13, after a brief illness.

DR. FRITZ HENNINGS, professor of railway construction at the Zürich Technical High School, died on February 2, at the age of eighty-three years.

PROFESSOR C. B. ATWELL writes: "It is our sad duty to announce the death, on March 4, of Associate Professor William Logan Woodburn, who for twelve years has been our colleague in the department of botany at Northwestern University. Born near Bloomington, Indiana, in 1882, he prepared for college in the near-by high school, completed the course for A. B. at the University of Indiana in 1908, was elected to the honorary societies of Phi Beta Kappa and Sigma Xi, acquired the master's degree by graduate work in 1909, and the doctorate of philosophy in 1912 at the same institution. During his twelve years at Northwestern University, he proved himself to be a conscientious, enthusiastic, and inspiring teacher, and a loyal, unselfish and sympathetic colleague. As an investigator he carried to successful completion and publication several valuable research problems in cytology, largely along the line of spermatogenesis in liverworts and mosses."

A CORRESPONDENT writes: "The death of Thomas Edward Clark, who in his early days was much interested in science, occurred at Los Angeles, California, on November 27, 1921, where he had resided for many years. Dr. Clark was born in Tyringham, Massachusetts, a small hamlet in the Berkshire Hills, on September 29, 1828. He received the degree of A. B. from New York University in 1849, B. S. from Harvard in 1854, Ph. D. from Göttingen in 1857. In 1859 he held the chair of chemistry at Williams College. He received the degree of M. D. from the College of Physicians and Surgeons in New York in 1866, and practised medicine for a few years in New York City. Following his retirement from the practise of medicine, he spent several years in Europe, largely in France and Italy. Upon his return he purchased a ranch in Kan-

sas where he resided for a few years, from which he retired to a life of leisure at Los Angeles, California. He was a fellow of the American Academy of Arts and Sciences, Boston, and of the Academy of Natural Science, Philadelphia. Dr. Clark descended from a stock noted for its production of naturalists, among them we find such names as Jackson, Orton, Kingsley. He was a brother of Henry James Clark, who was formerly associated with Agassiz at Harvard, and distinguished for his work on the invertebrata, etc. Their father, Henry Porter Clark, married Abigail Jackson Orton. He was a Swedenborgian minister but retired early in life. He was a lifelong friend of the Rev. Henry James, father of Henry and William James, who was likewise a Swedenborgian."

THE International Union of Pure and Applied Chemistry will hold a meeting in Lyons, France, from June 27 to 30.

THE American Pharmaceutical Association has available a sum amounting to $360 which will be expended after October 1 for the encouragement of research. Investigators desiring financial aid in their work should communicate before June 1 with Professor H. V. Army, Chairman A. Ph. A. Research Committee, 115 West 68th Street, New York, giving their past record and outlining the particular line of work for which the grant is desired.

THE United States Civil Service Commission announces an examination for ordnance engineer, qualified in optics. A vacancy at Frankfort Arsenal, Philadelphia, Pa., at $4,000 a year, is to be filled. The work will consist of the supervision of the design and manufacture of optical systems for military instruments, as well as investigating optical problems relating to such instruments. Competitors will not be required to report for examination at any place, but will be rated on physical ability 10 points, and on education and experience 90 points.

IN order to promote original research relative to the fungicidal and insecticidal properties of sulphur and the effects of sunlight, temperature and moisture on its action, the Crop Protection Institute expects to offer two fellowships yielding an income of $2,500 each. Training in chemistry and plant physiology is a prerequisite, and candidates should have demonstrated ability to undertake research efforts of a high type. Applications, accompanied by reprints of scientific articles and letters of recommendation, should be made immediately to the Crop Protection Institute, National Research Council, Washington, D. C. A statement explaining the purposes and scope of the projects and selection of research laboratory may be obtained on application.

UNDER stress of the economic conditions that the war has placed on Austria, the well known Zoologisch-Botanische Gesellschaft finds it necessary to part with some of its scientific collections as a means of maintaining its existence. A recent letter from Dr. Hans Neumayer, the general secretary of the society, to Professor Wm. Trelease, of the University of Illinois, asks that American botanists be informed of that fact that a collection of about 12,000 mosses, comprising over 1,000 species and collected by Schimper, de Notaris and other men famed in this branch of botany, is offered for sale. Detailed information may be obtained from the secretary of the Gesellschaft, at Vienna, and offers for its purchase may be addressed to him.

The first volume of a series of translations and reprints to be known as *Psychology Classics* is in press and will appear shortly. The series is to be edited by Professor Knight Dunlap, and published by the Williams and Wilkins Company in Baltimore. The first volume contains a translation, by Miss Istar A. Haupt, of Lange's monograph on *The Emotions,* with reprintings of William James's article, "What is an Emotion?", for *Mind* and his chapter on "The Emotions" from the *Principles of Psychology.* In order to facilitate the preparation of further translations and reprints, the royalties from these volumes will be matched by an equal amount by the Williams and Wilkins Company, the fund so constituted to be deposited with the treasurer of the Johns Hopkins University, and will be applied solely to the defraying of clerical and

other necessary expenses of such preparation. The editor requests suggestions concerning future volumes, and cooperation in their production.

UNIVERSITY AND EDUCATIONAL NOTES

AMONG appropriations announced by the General Education Board are: Northwestern University, toward $2,000,000, $600,000; Boston University, Boston, Mass., toward $1,500,000, $400,000; Illinois Wesleyan University, toward $400,000, $135,000; New York University, $500,000, toward $1,500,000; for the discharge of its outstanding obligations, $500,000.

DR. FREDERICK L. HOFFMAN has accepted the position of dean of what will probably be known as the "Graduate School of Applied Business Science, of the Babson Institute, at Wellesley Hills, Mass. Dr. Hoffman will continue his connection with the Prudential Life Insurance Company as consulting statistician, and will hereafter divide his time as may best meet the needs of his new work. In his new position he is expected to develop the business education for officers and managers of industrial undertakings, including insurance. The plans under way include an entire group of new buildings, and a museum of industrial products and processes. Dr. Hoffman will make his future home at Wellesley Hills.

DR. SIMEON BURT WOLBACH has been appointed Shattuck professor of pathologic anatomy in the Harvard Medical School, to fill the vacancy caused by the retirement of Dr. William T. Councilman.

LEIGH PAGE, Ph.D., assistant professor of physics in Yale University, has been promoted to be professor of mathematical sciences beginning with the academic year 1922-23, with assignment to the Sheffield Scientific School.

THE chair of mining at Sheffield University, vacant by the death of Professor F. E. Armstrong, has been filled by the appointment of Mr. Douglas Hay.

DR. HENRI CLAUDE has been appointed professor of mental diseases in the Paris Faculty of Medicine in succession to the late Dr. Ernest Dupré.

DISCUSSION AND CORRESPONDENCE

THE VOTE ON THE EVOLUTION BILL IN THE KENTUCKY STATE LEGISLATURE

ON March 9, the lower house of the Kentucky legislature, contrary to what was expected, took the anti-evolution bill (the one carrying a heavy fine and jail sentence for a violation of its provisions) out of the hands of the committee and put it to vote. Not since the memorable election of William A. Bradley to the Senate in 1908 has there been in the legislature such intense interest in the result of a ballot. As names were called the majority for and against see-sawed with narrow margins, and there was much scurrying hither and thither by the advocates and opponents of the bill for the purpose of finding and dragging in their respective absentees for the vote. It was like a neck and neck horse race, and Kentuckians do dearly love a horse race. The final ballot resulted in 41 votes for the measure and 42 against.

An analysis of the vote above recorded shows that with the legislative district taken as a unit and computing the percentage of illiteracy on the basis of the male population, twenty-one years old and upward, in each, the advocates of the bill represented an illiteracy of 13.5 per cent., and the opponents of the bill an illiteracy of 10.7 per cent. The illiteracy of the state as a whole computed on the same basis is 11.3 per cent.

In view of the closeness of the vote on this measure and what an analysis of it reveals as to the forces which were backing its passage, the proposal that the content of teaching in the state universities shall be dictated by legislative enactment, as advocated by Mr. Bryan, is fraught with interesting possibilities.

As interesting incidents connected with the final attempt to pass this anti-evolution measure, are the following:

Two persons, not members of the assembly, were permitted to address the house on the measure, President McVey of the university against it and Rev. Noel Gaines, of Frank-

fort, in favor of it. The latter exhibited standard text-books on zoology, and grew quite excited as he quoted evolutionary statements from them.

A representative, whose vote against the bill made it a tie, called up his pastor by long distance telephone, while the balloting was yet in progress, and asked for advice as to how to cast his final vote.

The representative from Breathitt County, one of the counties of the mountain section, where anti-evolution sentiment is strong, surprised everybody by voting against the bill; indeed it was he who cast the deciding ballot. This county is known as "Bloody Breathitt," because of its distinctive lead in homicides growing out of private feuds. This member can scarcely be said to represent the sentiment on evolution in this county, which has an illiteracy of 21.6 per cent. It is doubtless more correctly represented by the editor of the *Jackson News* of that county, who recently said, "The professors at the state university may believe they are descended from apes and baboons, but let it be known that the good people of Breathitt are pure Anglo-Saxon."

ARTHUR M. MILLER,
DEPARTMENT OF GEOLOGY,
UNIVERSITY OF KENTUCKY,
LEXINGTON, KY.

ROTERTIA

IN the mind of the student the word "moment" is unalterably connected with the idea of a very short space of time. Such an expression as "moment of force" is, therefore, on the face of it, meaningless. It is useless for the teacher to point out that "moment" also means importance, and that the moment of a force is merely its importance or effectiveness in producing rotation. Calling it a "moment of force" makes "a tendency to produce rotation" a difficult physical conception for the student to grasp. This difficulty has been recognized by teachers of physics, who have at last very generally discarded the expression "moment of force," in favor of the shorter, simpler, and clearer term "torque." A torque is a twist. There you have the whole thing in a nut-shell, and the student knows what you are talking about.

Why not keep up the good work by accepting suitable substitutes for "moment of momentum" and "moment of inertia" as well? If "moment of force" is bad, these are worse. Some text-book writers have already seen the wisdom of using "angular momentum" for "moment of momentum." This is a distinct improvement, since "angular momentum" carries its meaning on its face. But so far I have failed to find any serious attempt made to use a substitute for "moment of inertia," although, to my mind, this is the worst offender of the three. The magnitude of a moment of force is calculated by multiplying a force by a distance ($f \times r$); similarly that of a moment of momentum by multiplying a momentum by a distance ($mv \times r$); but the magnitude of a moment of inertia is *not* equivalent to the product of an inertia times a distance ($m \times r$), but times the square of a distance ($m \times r^2$). The use of the word "moment" in all three cases, therefore, misleads the student to expect an analogy which does not exist in the case of moment of inertia, thus making the term particularly inappropriate. My experience has been that the word "rotertia" immediately conveys to a student the physical conception buried in the expression "moment of inertia"; and in such a way that it is not easily forgotten. I therefore seriously urge its adoption. "Rotertia" on the face of it is equivalent to rotational inertia; and, hybrid though its stock may be, what more can we demand of a technical term than unambiguity, clarity, and force?

FREDERICK PALMER, JR.
HAVERFORD COLLEGE,
NOVEMBER 14, 1921.

THE VALUE OF TILTH IN AGRICULTURE

DR. JEROME ALEXANDER (in SCIENCE, February 10, 1922) criticises a statement made by the present writer (SCIENCE, September 2, 1921) that "the comminution of the surface of the soil, *more or less perfectly stops evaporation and thus conserves the store of soil water.*" This statement is said by Dr. Alexander to be "quite contrary to all engineering

and practical experience"—the fact being, according to him, that such breaking of the upper surface "causes or tends to cause *increased* evaporation."

The statement made by the present writer may possibly be contrary to "engineering" experience, but that it is a truism well known to all practical farmers from the days of King Hamurabi to date, can not be gainsaid.

I quote from "Soil Fertility and Permament Agriculture" by Dr. Cyril Hopkins, page 579—"In the semi-arid regions, fallow cultivation is practiced during one season, *the soil being stirred after each rain to prevent evaporation*, and thus store up sufficient moisture in the soil to give the crop a good start" (italics mine).

There is scarcely a more well known practice inculcated by practical farmers, in regions where droughts are feared, than the absolute necessity of keeping the surface covered with finely broken soil, for the specific purpose of conserving the soil water.

In semi-arid regions, this practice is absolutely essential to the farmers' financial life, and most "farm periodicals"[2] harp upon this string in season and out.

L. S. FRIERSON

GAYLE, LA.

QUOTATIONS

PROPOSED LEGISLATION AGAINST THE TEACHING OF EVOLUTION

IN KENTUCKY[1]

THE Kentucky House of Representatives spent five hours to-day [March 9] in discussing and hearing discussions of the "monkey bill" of Representative G. W. Ellis of Barren County, forbidding the teaching of evolution in public schools and universities. The measure was defeated by a vote of 42 to 41, after a recapitulation of the vote during which members were dragged into the chamber from other parts of the capital.

Dr. F. L. McVey, president of the state university, and the Rev. Dr. E. L. Powell, pastor of the First Christian Church, Louisville, discussed the bill by invitation. The former declared that the legislature is not within its rights in passing such a law as that proposed, and urged the members not to base the inspiration of the Bible on matters not essential, but to heed teachings of the Book. He asserted that the Bible is not an authority on science, legislation, chemistry, or any of one thousand other subjects, but on moral, spiritual and religious matters. Dr. McVey went into the subject of evolution, pointing out that many accept the teachings as not in contradiction to the Bible, and insisted that the university makes no attempt to interfere with the religion of its students. He told of the various religious activities of the university, and warned the House that it would set a dangerous precedent in the passage of the Ellis bill. He recalled fights on scientific theories in the past based on the ground that they are opposing the Bible, and reviewed briefly the manner in which various scientific subjects are taught.

Mr. Ellis brought forward Noel W. Gaines of Frankfort, formerly an army officer, who has been in the limelight several times in his career, most recently when he was involved in the "ground glass" controversy in a Southern camp, to speak for the bill. Mr. Gaines put William Jennings Bryan to shame in his denunciation of those who believe evolution, directing many of his remarks directly at Dr. Powell and Mr. McVey. He talked for nearly an hour and was frequently applauded and cheered, while spectators in the gallery and around the walls of the chamber roared with laughter. One of his "stunts" was a division of the sheep and goats, placing Dr. McVey, Dr. Powell and various zoology text books on the one side and the Bible, the Declaration of Independence and himself on the other. He had the books before him as he ran up and down behind the clerk's desk, scattering them about as he waved his arms in emphatic gestures. Finally he threw one of the text books to the floor and trampled it under foot.

"I am ashamed of this day in the Kentucky legislature," said Representative G. C. Waggoner of Scott County, a minister and veteran legislator, toward the close of the debate.

"This bill smacks of intolerance and the

[1] Abridged from the *Louisville Courier-Journal*.

shadows of the Dark Ages are settling about us." Mr. Waggoner opposed the bill on the ground that in passing it the legislature would exceed its functions as a law-making body and would set a dangerous precedent. "There have been times here to-day when those on both sides of this discussion were about ready to place their opponents on the rack and torture them," continued Mr. Waggoner. "I don't know anything about evolution and from what I've heard I don't believe there are others here who do. We have set up a straw man and have been boxing industriously at him all day."

In his final appeal for the passage of his bill, Mr. Ellis said he had sent his son to the University of Kentucky and that he returned with his faith destroyed and argued religion against his father and mother. The voice of the aged representative was broken with emotion as he told of this experience.

When the roll was called the vote stood 38 to 36 for the bill, which meant its defeat, as 40 votes are required for passage. As Mr. Meyers was about to announce this the proponents demanded that the absentees be called. Then the vote was 40 to 39 for the bill. The opponents demanded a recapitulation. During that they dragged in two more members and the proponents one, making it 41 to 41. Representative Bryce Cundiff, who had declined to vote on the ground that he "was a hard shell Baptist and believed what was would be anyhow," said he would have to discard his religion and vote "No." Then the bill was declared to be defeated by a vote of 41 to 40.

IN SOUTH CAROLINA[1]

The teaching of "the cult known as Darwinism" as "a creed to be followed" is prohibited in all state supported public schools and institutions of higher learning by a proviso attached as a rider to the general appropriation bill by the Senate yesterday morning. The amendment, which was tagged on to the end of the section providing for the appropriation of funds for the public school system, would make it impossible for any public school or higher institution of learning teaching or permitting "Darwinism" to be taught to receive any funds from the state and would prohibit the paying of state funds to any such institution. Senator F. A. Miller of Hartsville is the author of the proviso, which was adopted by the Senate, practically without opposition.

Ultimate fate of the proviso, which took its place as one of the Senate amendments to which the House refused concurrence, will therefore have to be determined by the conference committee to which the appropriation bill was referred. None of the representatives on this committee from either house have announced their stand on the question and since the House has never explicitly expressed itself on the question the House conferees will consider the proviso without any idea as to the House's stand on the matter.

The amendment was passed in the Senate practically without debate or opposition, Senator Miller making the only address either for or against the measure. The proviso follows in full:

> And provided, further, That no moneys appropriated for public education or for the maintenance and support of state supported institutions shall be used or paid to any such school or institution teaching, or permitting to be taught, as a creed to be followed, the cult known as "Darwinism."

The proviso contains no definition of "Darwinism" and is intended, Senator Miller explains, to apply only to Darwinism and therefore not to the theories of evolution of Lamarck, Bergson, Le Dantec, Baldwin, Osborn, and the many others who have since Darwin's day practically thrown "Darwinism," as it was first enunciated, into the discard. The amendment applies, Senator Miller points out, only when "Darwinism"—which is now defined as the theory of natural selection, that is, the survival of the fittest in the struggle for life, was the mechanism by which evolution was accomplished—is taught or permitted to be taught "as a creed to be followed" and not when it is

[1] From the Columbia *State*. The amendment was eliminated from the bill by the conference committee appointed to adjust differences between the bill as passed by the House and by the Senate. It is said that another attempt will probably be made to pass the bill when the legislature meets next year.

merely explained to the pupils as the pagan philosophies are explained.

SCIENTIFIC BOOKS

The Friendly Arctic. V. STEFANSSON. The Story of Five Years in Polar Regions, with a foreword by Gilbert Grosvenor, president of the National Geographic Society, and an introduction by Sir Robert Borden, Prime Minister of Canada. New York (Macmillan) 1921. Pp. xxxi + 784.

IT is the habit of scientific men to say that there is no guide for the well-ordered conduct of the every-day business of living which approaches in validity and all-round usefulness that which is called the scientific method. But while this is strictly orthodox and extremely common preaching, the thoughtful observer of human folkways can not but be impressed with the fact that the correlation between this trite preaching and the actual practice of his friends in the conduct of their own lives, is not of as high an order as it would be expected to be if the preaching were taken at its face value. It is, therefore, an event of great human interest as well as of no mean scientific importance to have forthcoming a well-nigh complete and perfect example of what happens when scientific methods of thought are translated into action, with something approaching 100 per cent. completeness, to the end of living happily, usefully and continuously in a naturally harsh environment. Such an event is afforded in this recent book by Stefansson.

It is from this point of view that, in my opinion, the book has its greatest significance. It contains a wealth of records of achievements in the field of geography in the narrower sense of the word—discoveries and descriptions of new lands, exploration of the bottom of the polar sea by soundings, much exact mapping of coast lines, and the like—which I suppose to be of major importance in those fields of science, but being in no wise a specialist in either geography or polar exploration, I am not qualified to express any expert opinion on these matters. But I have a strong conviction, after carefully reading the book twice, that the importance which the history of science is going to attach to Stefansson's work in the polar regions will rest primarily upon quite another thing than his contributions to geography in the strict and limited sense, significant as I have no doubt these contributions are.

In temperate, sub-tropical and sub-arctic portions of the earth's surface certainly, the zone of freedom in human behavior is, from the viewpoint of evolution, rather wide. Men in such regions are, and must always have been, widely free to develop any sort of habits of life and folkways in general, so far as the eliminative action of the purely physical environment was concerned. For example, it makes no difference in terms of survival value so far as one knows, whether ladies dress in the entertaining and colorful manner of the Rumanian peasant, or in the quite different if not less exciting manner of the Fifth Avenue society woman. But the case is biologically quite different in the polar regions. There the zone of freedom in respect of the mode of conducting life is extremely narrow. The environment imposes strict and narrow limitations on habits and biological folkways generally. One conforms or is eliminated. There is no wider range of choice.

Now presumably the Eskimo's knowledge of how to live happily, comfortably and reasonably long in the Arctic has been very slowly and somewhat painfully wrought into his racial and individual consciousness mainly by the operation of natural selection. Those who did not dress, house themselves, find food, etc., within the limits of the zone of freedom of individual action rigidly set by the environment are no longer either present or represented in the Eskimo population. The consequence is that the Eskimo is now, as Stefansson has demonstrated with a wealth of detail in this and his earlier book, "My Life with the Eskimo," a creature extraordinarily well adapted to his particular environment, and therefore happy in it.

Prior to Stefansson's work the whites who have adventured into the Arctic as explorers, and the list is a nobly impressive one, have uniformly depended upon what is, in its philosophical essence, one and the same scheme to

avoid the consequences of the stark evolutionary processes there operative. This scheme has been essentially to provide sufficiently adequate transport facilities, by sea and by land, so that the physiologically obligate elements of the environmental complex, food, heat, shelter and clothing, could be in whole or in part taken from the temperate zone into the Arctic and act as a buffer between the exotic white man and the indigenous environment. In short what the Arctic explorer has always endeavored to do is to project, like a pseudopodium, a piece of the temperate environment into the Arctic environment, and move in and out of the country along the center of the pseudopod.

Stefansson's plan is philosophically quite different. It is based biologically upon the considerations: first, that the physiologically obligate essentials of life must be generally if not universally present in the Arctic, else there could and would be no Eskimos there; and second, given that these essentials are there, a sufficiently acute, penetrating and optimistically sympathetic application of the reasoning faculties of the scientifically trained mind should enable one man to avail himself of them and hence *live,* as well as another. It is quite easy, given a sufficient lack of knowledge of the facts, on the one hand, and of imagination, on the other hand, to prove conclusively by *a priori* logic that this theory of Stefansson's is all wrong. In point of fact a considerable number of the members of his expedition logically excogitated the matter and came to the conclusion that in holding such views Stefansson was not merely silly but probably also insane, and in consequence felt justified in (a) disobeying his orders as Commander of the Expedition, (b) in refusing to render him any aid (cf. pp. 114-115 regarding chronometers), and (c) in actively hindering his preparations and subsequent operations.

The best possible refutation of a purely logical proof that Stefansson's theory was all wrong was, of course, to carry through, over a long period of time and a wide range of area, travels in the polar regions, living entirely off the country as the native Eskimos do. Precisely this is what Stefansson did for a period of nearly five years, with brilliantly successful results, viewed from any standpoint. "The Friendly Arctic" is the record of how it was done and of what happened. With two or three companions, a few generally poor sledges (because the good ones were either left on the Karluk or retained by the logical but unimaginative southern party), some dogs, a rifle apiece with a modicum of ammunition, a little scientific apparatus for observing, *et præterea nihil,* Stefansson moved about over the polar ice and lands freely at will, and added richly to the world's knowledge of the regions.

Every one who is interested in the philosophy of evolution, general biology and human psychology, as well as those interested in geography and Arctic exploration, should read this fascinating book. It records an extraordinary intellectual achievement.

RAYMOND PEARL
SCHOOL OF HYGIENE,
THE JOHNS HOPKINS UNIVERSITY

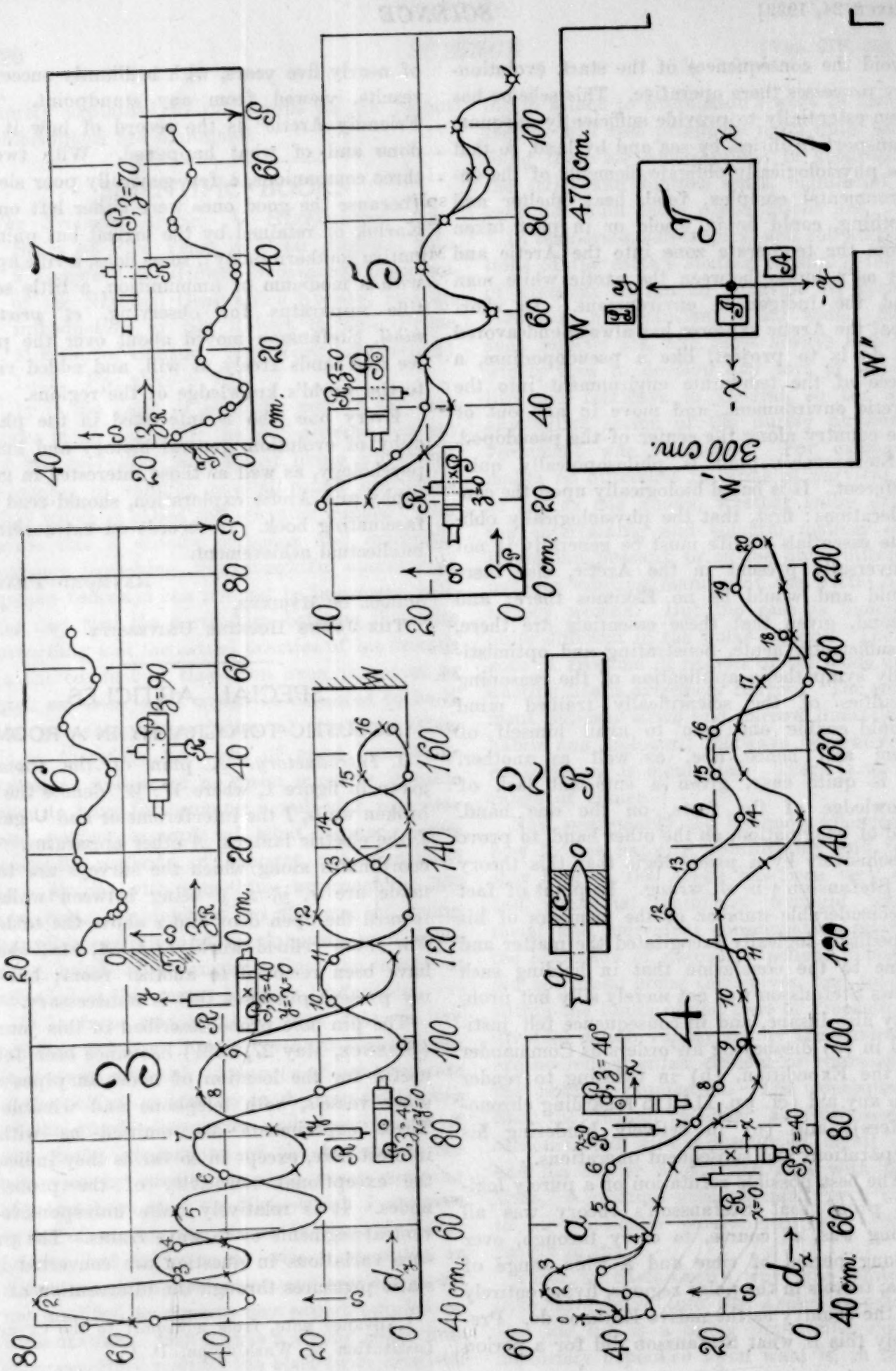
SPECIAL ARTICLES

ACOUSTIC TOPOGRAPHY IN A ROOM[1]

1. *Introductory.*—A plan of the room is given in figure 1, where W, W' denote the unbroken walls, I the interferometer and U-gauge, L the electric lantern, A other apparatus. The coordinates along which the surveys are to be made are x, y, z, y being between walls, x toward the open door and z above the table T. For more refined work, I. L, A, etc., should have been removed to another room; but for my present purposes this is unnecessary.

The pin hole probe described in this journal (SCIENCE, May 27, 1921) has since been found useful for the location of nodes in pipes and other vessels, both telephone and windblown. These experiments are omitted as without interest here, except in so far as they indicated the exceptional sensitivity of the probe to nodes. It is relatively quite unresponsive to ventral segments or to wave trains. The pressure variations in question are converted into static pressures through the intervention of the

[1] Advance note, from a Report to the Carnegie Institution of Washington, D. C.


1
2
3
4
5
6
7
470 cm.
300 cm.
40 cm.
0 cm.

pin hole and measured at a mercury U-gauge, read by displacement interferometry. As the pipes to be employed were to be of all kinds and intensities, it did not seem worth while to reduce the fringe-deflections to pressures. These deflections will therefore be reported as measured on an arbitrary scale s (.1 mm. collimator plate micrometer). The width of a fringe was however on the average about 2 scale parts. Thus the corresponding pressure increments p are readily found from $p = .00015\ s$ millimeters of mercury. The apparatus can be made more sensitive by enlarging these small fringes; but the latter would then usually be thrown out of the field of the telescope and the screw micrometer become necessary to restore them, which is irksome, particularly with fringe U-gauges.

The pin-hole probe at one end of an eighth inch pure rubber tube of any length (2 to 3 meters or more), at the other end of which is the gauge, is at once available for introduction anywhere. It fails however to give an appreciable acoustic record except in the inside sounding pipes. The plan of associating the pin hole probe with a resonator, of either the open or closed type, thus suggests itself.

2. *The closed pin hole resonator.* The outstanding trouble encountered heretofore was ascribed to the organ pipe; *i. e.*, to the continuity of notes lying very close together, but to only one of which the resonator responds effectively. A further difficulty was referable to two ends of the open cylindrical resonator then used, with a pin hole in the middle within; for these ends being 22 cm. apart are liable to lie in regions differing acoustically. The advantage of the tube is the ease with which it may be accurately tuned by mere elongation and hence its sensitiveness. The Helmholtz resonator, probably for this reason, was found much less sensitive. Hence the closed pin hole resonator qR, figure 2, suggests itself, consisting of the cylindrical tube (1.9 cm. diam., effectively 22 cm. long) R, closed by the snugly fitting cork c which carries the pin hole probe qO. The pin hole, O, is at the base of the tube R, the quill tube q being connected, as stated, by a length of gum rubber tubing with the U-gauge. This resonator has but one mouth and thus tests acoustically a single point, as it were, of the region, while the tuning may be effected with nicety by moving the cork c within R, or by elongation at the mouth of R. The pin hole at O must be salient (*i. e.*, carried by the conical end of the quill tube q) and not on a reëntrant or flat end. Moreover, the diameter of the pin hole must bear a certain relation to the size of the resonator R, to be found by trial. The construction of a sensitive pin hole resonator is extremely difficult; out of dozens of trials I netted but one or two adequately sensitive instruments. If of metal foil, it is liable to change in the lapse of time.

3. *Survey between walls; y coordinate.* The two series of results (pipe in azimuth 180° at $x = y = 0$, $z = 40$ cm., and resonator in azimuth 90° and 270°, respectively, at $z = x = 0$ and y) are given in figure 3. The abscissas, d_y, are the distances between centers of pipe P and resonator R. The y values of R (on the table) are given in decimeters on the curves. Insets show the orientation. The two curves are pronouncedly harmonic from $y = 0$ to the wall, and they are almost exact inversions of each other, crests in the one taking the place of troughs in the other, throughout. Moreover the crests seem to lie in successive levels; an initial high one (y = 10-20 cm.); an intermediate lower one (y = 30-80 cm.); a still lower one (100-140 cm.) beyond; etc. It is not feasible to go much beyond 160 cm.; for with the wall at 174 cm. the resonator pitch is beginning to be modified. A curious result is the initial maximum and minimum, the points not being at $y = 0$, but beyond at $y = 20$ cm. The horizontal mean wave lengths Δy to be obtained roughly from these curves are respectively $\Delta y = 34$ cm. and $\Delta y = 35.5$ cm., the range being from 30 to 40 cm. The mean d intervals, Δd_y, are about 30 cm.

The precipitous descent of the graphs between $y = 70$ and 90 in one case and $y = 90$ to 100 in the other, makes less impression on the wave intervals than would have been anticipated and the mean wave length here, $\lambda = 35$ cm., does not differ from the earlier cases of $\lambda = 37$ cm. by more than the observations of a single curve. The graphs,

figure 3, were obtained independently, one after the other.

Now in the line PP', normal to the wall W, 40 cm. above the table between pipe P and pipe image P' in W, the nodes should follow each other at a distance of $\lambda/2 = 24$ cm. apart; but as the distribution above and below is hyperbolic, the nodes at the level of the table must be further apart. Unfortunately, the equation is cumbersome. Without attempting to use it here, we easily surmise that the increased distance so obtained is inadequate; *i. e.*, not as large as the 35 cm. intervals found in the experiments, in place of $\lambda/2 = 24$ cm. estimated to increase to 27 cm. or 29 cm. One should expect 7 or 8 nodes in place of the 5 or 6 recognized. Thus it seems not unlikely that a frequency of a near order is contributed by the room itself, particularly as the reflected waves returning from 2 meters are too weak to compete effectively with the outgoing wave trains. Furthermore, there is another wall in the direction of negative y (at $y = -130$) and one at $x = -190$ cm. Although apparatus lies in the path here, they introduce further complication.

There remains the reflection from the table, so that the pipe and its image 40 cm. below, make the plane of the table a region of reenforcement; or, with regard to the loss of $\lambda/2$ at the surface, a locus of nodes, though the term node would be strictly applicable only for the case of normal incidence near the line pipe-image. The next nodal locus is hyperbolic and therefore higher than 25 cm. above the table, out of reach of the resonator which lies on it. Thus it is finally necessary to compound the phase reversed direct ray here in question, with the corresponding phase reversed reflections from the walls, to get the disturbance at any point of the table. This succeeds experimentally, as I will point out presently, for walls close at hand (within a meter or two); but for walls as distant as those of the room, the reflection wall effect is too small to account for variations as marked as those of figure 3. It is possible that a wide high wall, like W, may act obliquely by diffraction; but to speak on this subject, further inquiry will be needed. As a general fact, however, it is noticeable that a survey in y, between walls, here produces a much more marked harmonic distribution of acoustic pressure along that axis, than a similar survey along x toward the open door (§4).

The striking opposition of phase which figure 3 presents for an inversion of the resonator is more easily intelligible. As the length of the resonator is approximately $\lambda/4$, the rotation of 180° about its center will pass the mouth from a node to a loop of the stationary wave train, or between corresponding 90° phase differences. Now the pin hole probe, as above stated, is sensitive to nodes (compressions) only and scarcely responds to wave trains (or to the similar harmonic motion at the loops). The pin hole resonator might be thought to have the opposed quality, being stimulated by wave trains (or loops) and not by nodal phenomena or compressions: but (§ 5) this inference is not correct. We must therefore again anticipate nodes at the maxima of the graph and loops at the minima, when the pin hole resonator is used.

It follows from this that if half of the length of the resonator be added to the y coordinate of one of the graphs, figure 3, and half the length be deducted from the other, *i. e.*, if the *mouth* of the closed resonator be taken to define the coordinate y, the two curves of figure 3 should coincide at their mean position in y. Hence if the resonator is rotated on an axis passing through its mouth, the data obtained should be constant at all angles. Experiments were specially made to corroborate this inference.

4. *Survey (in* x*) toward the open door.* The example of this survey, which I will here communicate, was made somewhat differently from the preceding, by locating the resonator at the origin ($x = y = z = 0$) in two azimuths, 90° and 270°, successively. The pipe, kept horizontal, parallel to y and 40 cm. above the table, was now moved along the axis x. The abscissas, d_x, still refer to the distance between the centers of the pipe and resonator, while the coordinates x are marked in decimeters on the curves. The graph then shows the effect at the origin, of an f″ pipe sounding at different points along x, and the pressure distribution are here throughout quite different from

the y distribution between walls. The case for R 90° is now a compound harmonic which seems to dip into stationary wave trains at a and b. The other curve is quite similar in general character, only less pronounced. Horizontal wave lengths exceeding 35 cm. may again be detected at the double inflections.

5. *Survey in the vertical direction* (z). This was carried out by allowing the resonator to rest horizontally on the table, in a direction normal to the f″ pipe, the latter being raised successively in steps of 10 cm., keeping it in the same azimuth of 0°.

The graphs (figure 5) for two positions of the resonator are essentially identical, indicating stationary waves produced by reflection from the table. The z distance between crests and troughs, however, now varies between 24 and 25 cm. and thus corresponds very closely to the semiwave length, 24 cm., of the f″ pipe. In all cases the pipe must be raised some distance (40 cm.) before the periodic distributions begin.

The behaviour here in evidence is very much like Melde's experiment, though it is now made with a string of air (as it were) between the actuating organ pipe as one attachment and the table as the other. The only adjustment possible is thus the length of the string. Since the resonator lies on the table, certainly to be regarded as a nodal surface, we would be inclined to look for the maximum of wave production, when the direct and return wave train coincide in phase at the mouth of the pipe. This will take place at intervals of $\lambda/2$, or $\Delta z = 24$ cm. apart, conformably with the graphs. It would seem, however, that the maxima (in view of the loss of $\lambda/2$ at the table) should lie at $z = 5\lambda/4, 7\lambda/4$, etc., whereas in the graphs they lie at $2\lambda/2, 3\lambda/2$, etc. The latter demand a node at the mouth of the f″ pipe.

As the table is certainly a nodal surface, we here encounter the result of special sensitiveness to nodes on the part of the mouth of the pin hole resonator. The case is tested in figure 6, where the pipe, P, in azimuth 0° is $z = 90$ cm. above the table and the resonator vertically below the pipe is raised from the table at $z = 0$. The evidence given by the curve is very satisfactory, the wave lengths of the graph being 24 to 25 cm., or semi wave lengths of the f″ pipe. There is complete absence of deflection at 10 to 12 cm. above the table; *i. e.*, at $\lambda/4$ for the pipe, so that the ventral segment is inactive. As the pipe at $z = 90$ cm. is approached by the resonator, the deflections naturally increase, but they do so very slowly. Obviously the present disposition with a raised pipe and with the resonator between pipe and table is conclusive; but because of the important evidence obtained I repeated it for an f″ pipe at $z = 70$ cm. (nearly $3\lambda/2$). The results in figure 7 are of the same kind as to wave length, inactivity for a resonator 12 cm. ($\lambda/4$) above the table, the marked effectiveness (maximum) of the distant node at the table ($z = 0$) and a maximum near the pipe ($z = 68$ cm.). Troughs and crests lie at positions which are multiples of $z = 12$ cm.

The above results for normal reflection may be summarized as follows: Both the organ pipe and the pin hole resonator are stimulated in proportion as their mouths lie in a nodal region or surface; they remain relatively uninfluenced by a ventral segment. Consequently an even number of half wave lengths lie between pipe and resonator when the response is a maximum. Although the mouths of the respective pipes are necessarily ventral segments, the anomalous features of these results disappear when it is remembered that the nodes are alternately dense and rare.

6. *Reflection from plates.* Using a plane about 1x.5 square meters in area, displaced along x and normal to it, in steps of 10 cm. from the origin successively, the effect of reflection (as I shall show elsewhere) came out beautifully. It was possible, by compounding the direct and reflected rays in each case, to interpret the harmonics and compute the wave length of the pipe accurately. At the distance of the wall (174 cm.), however, the reflection effect had dwindled to 10 to 15 scale parts. Diminution of the reflection effect also occurred when the plane was placed oblique to x, but not as abruptly as the law of reflection would predict. Furthermore the distribution of height in the successive maxima in the different reflection curves was quite as remote from